

Remarks

Applicants appreciate the courtesy of the telephone interview with Examiner Lawrence on June 9, 2005. During the interview, applicants discussed features of the claims that distinguish the references cited against this application.

I. Rejection under 35 U.S.C. § 102(b) over Sircar's U.S. Patent No. 4,756,723

A. Independent Claim 159

Claims 159-160, 163-164, 172, 194-195, 203-204, 256, 258 and 259 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Sircar's U.S. Patent No. 4,756,723 (Sircar). Applicants traverse this rejection, and request that it be withdrawn.

Other than claims 258 and 259, all rejected claims depend from independent claim 159. With respect to the features of claim 159 and the disclosure by Sircar, two primary types of contaminate flow through guard material, and potentially flowing into and contaminating adsorbent material, are problematic. First, the feed fluid itself may comprise contaminant. During a period of feed fluid flow contaminant may adsorb onto the guard material. Second, there may be periods during which feed fluid flow is interrupted. During these periods contaminant adsorbed to guard material can diffuse to adjacent adsorbent material. For example, if plural adsorbent beds are operating, feed fluid flow to a first adsorbent bed may be interrupted and directed to a second adsorbent bed. As a second example, feed fluid flow to the adsorbent may be interrupted for longer periods of time, such as when a parked PSA is not processing fluids.

Claim 159 includes claim features concerning diffusion-based contamination that distinguishes Sircar. Specifically, claim 59 recites "reducing diffusion of the at least one contaminant from the guard material to the at least one contaminant sensitive adsorbent material." Diffusion-based contaminant flow is discussed throughout the present application. The following text excerpts illustrate disclosure provided by the present application concerning diffusion-based contaminant flow and the problems associated with diffusion of contaminant from guard material to a contaminant-sensitive adsorbent. Several methods for reducing contaminant diffusion also are disclosed in the present application to support the claim features recited in claim 159.

When a PSA unit is shutdown, any adsorbed contaminant in any part of the adsorber

may diffuse detrimentally into contaminant-sensitive zones of activated adsorbent to cause deactivation.

Page 6, lines 17-19 (emphasis added).

Forward diffusion of contaminants previously adsorbed in the guard layer of the adsorbers may progressively deactivate the contaminant-sensitive adsorbent whenever the PSA unit is shut down. Alternative disclosed approaches for addressing forward diffusion include (1) isolation valves, (2) purging during shutdown in order to reduce the contaminant content of the guard layer, (3) operating at relatively higher temperatures in normal operation to reduce steady state content of contaminant in guard layer, (4) cooling the guard layer during parked mode, (5) providing intermittent or continuous purge during parked mode, and (6) providing intermittent start up and/or normal operation sequences during park mode to drive back the diffusion front to prevent contamination of the contaminant sensitive adsorber material, and all possible combinations thereof.

Page 24, line 22, page 25, line 1 (emphasis added).

Forward diffusion of contaminants can be reduced using plural guard layers. A first guard material can be separated from at least a second guard material, the guard material layers may abut, or there may be a blend of at least a first and second guard material. A second guard material with reference to fluid flow along a flow path from the feed end to the adsorbent may have a larger capacity and a stronger affinity for the contaminant than a first guard material to reduce forward diffusion rates.

Page 26, line 16-21 (emphasis added).

As currently understood, Sircar does not recognize the problems associated with forward diffusion of contaminant, and no solution is taught or suggested by Sircar for reducing forward diffusion of contaminant from a guard material to a contaminant sensitive adsorbent material. The present application not only identifies these problems, but also enables a genus of structural and process mechanisms useful for reducing contaminant diffusion.

For the reasons stated above, claim 159 is not anticipated, nor is it obvious in view of, Sircar.

Claims 160, 163-164, 172, 194-195, 203-204 depend from independent claim 159, and are allowable over Sircar for the reasons stated above with respect to claim 159. These claims also are allowable over Sircar in view of the patentable combinations of features recited in these claims.

For example, dependent claims 194 and 195 further require the use of a process containment seal. As currently understood, Sircar does not teach using process containment seals, nor does Sircar teach the combinations of features recited in these dependent claims. The rejection of claims 194 and 195 should be withdrawn for this additional reason.

B Independent Claim 258

Independent claim 258 also is rejected over Sircar. Applicants traverse this rejection and request that it be withdrawn.

Contaminant can originate from a feed fluid comprising contaminant that flows into the guard material and/or the adsorbent material. Contaminant also can originate from sources other than the feed fluid. Independent claim 258 includes features that address contaminants that do not necessarily originate from feed fluid flow. For example, independent claim 258 states that a process containment seal, fluidly connected to the at least one adsorber, is provided to further reduce influx of contaminant from a source other than the process feed fluid.

No containment seal is taught, discussed or suggested in Sircar. Applicants therefore request that the rejection of independent claim 258 over Sircar be withdrawn.

Claims 259-264 depend from independent claim 258. These claims are allowable for the reasons stated above with respect to claim 258, and further in view of the patentable combinations of features recited in these claims.

For example, dependent claim 259 further states that the process containment seal is configured to allow at least a portion of contained process fluid to flow across the seal. Sircar does not teach or suggest a process containment seal, and hence does not teach or suggest a process containment seal configured to provide the features of dependent claim 259. Claim 259 is allowable for this additional reason.

II. Rejections under 35 U.S.C. § 102(b) over Schaub *et al.*, U.S. Patent No. 5,989,314

Claims 159-160, 163-164, 172 and 256 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Schaub *et al.* U.S. Patent No. 5,989,314 (Schaub). Applicants traverse this rejection, and request that it be withdrawn.

Several features highlight the distinctions between Schaub's disclosure and the invention recited in claim 159, including "contaminant" and "contaminant-sensitive adsorbent," which are terms specifically defined in the present application. "Contaminants" are gases that "will not desorb from the adsorbent at the designed regeneration pressure, in the designed time of this portion of the cycle."

Page 12, lines 21-23 (emphasis added). Schaub identifies water as a material that may be in a feed

fluid. Schaub also describes using alumina as an adsorbent. Water adsorbs to alumina. But, Schaub specifically teaches that water desorbs from alumina during normal operation of the PSA device and hence is not a contaminant as defined in the present application when the adsorbent is alumina. Specifically, Schaub states that:

Thus, when such adsorbed water is desorbed during the next desorbition regeneration portion of the PSA cycle in said vessel, the cooling effect can be readily transferred to the heat capacity porous material that forms integral regenerative heat exchange zone 4 (emphasis added).

Schaub, column 5, lines 26-31.

Thus, to reiterate, water can be desorbed from alumina under normal PSA operating conditions, and hence is not a contaminant for alumina.

Schaub's disclosure highlights the fact that there is a relationship between a contaminant and the adsorbent material. Certain materials that are contaminants for a first adsorbent material (e.g. water is a contaminant for zeolite adsorbent) may not be contaminants for a second adsorbent material (water is not a contaminant for alumina). Because Schaub teaches desorbing water from alumina during normal PSA operation, Schaub does not anticipate the combination of "contaminant" and "contaminant sensitive adsorbent" features recited in independent claim 159.

Claims 160, 163-164, 172 and 256 depend from claim 159, and are allowable for the reasons stated above with respect to claim 159, and further in view of the patentable combinations of features recited in these claims.

For example, claim 256 further requires regenerating the at least one contaminant-sensitive adsorbent in the at least one adsorber. Regeneration is required when the adsorbed material is a contaminant. Schaub's disclosure clearly teaches desorbing water, a non-contaminant for alumina, during a normal PSA operation. Claim 256 is allowable for this additional reason.

III. Rejections under 35 U.S.C. § 103 over Sircar in view of Dangieri

Claims 161, 165, 173, 196, 198-199, 202 and 205 are rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Sircar in view of Dangieri *et al.* U.S. Patent No. 4,406,675 (Dangieri). Applicants traverse this rejection, and request that it be withdrawn.

For the reasons stated above, Sircar does not teach the combination of features recited in

independent claim 159 concerning reducing diffusion of the at least one contaminant from the guard material to the at least one contaminant sensitive adsorbent material. Dangieri makes no mention of removing contaminants from a feed fluid, and appears to make no reference to particular contaminants, such as water. There is no disclosure provided by Dangieri contemplating the problems associated with contaminant degradation and/or deactivation of adsorbents. As a result, (1) there is no motivation or suggestion provided by either Sircar or Dangieri to combine the disclosures of the two to address, for example, forward diffusion of contaminant, and (2) even if there is a suggestion to combine Sircar and Dangieri, which applicants contend is incorrect, the combination of the two disclosures nevertheless does not teach or suggest the combination of features recited in claim 159.

For the reasons stated above, claim 159 is not obvious over Sircar in view of Dangieri. Claim 169 has been cancelled. The remaining rejected claims 161, 165, 173, 196, 198-199, 202 and 205 depend from claim 159 and are allowable for the reasons stated for independent claim 159. These claims are further allowable in view of the patentable combinations of features recited therein.

For example, claim 196 further requires using a process containment seal, and the combination of features of independent claim 159 and a process containment seal is not taught or suggested by the cited references. Claim 196 is allowable for this additional reason.

IV. Rejections under 35 U.S.C. § 103 over Sircar

Claim 257 is rejected as being unpatentable over Sircar. Applicants traverse this rejection and request that it be withdrawn.

Claim 257 depends from independent claim 159. Sircar does not teach or suggest the features of independent claim 159 for the reasons stated above. For example, Sircar does not appreciate the problems associated with forward diffusion of contaminant, and provides no solution to a problem it does not recognize. Since claim 159 is allowable over Sircar, claim 257 also must be allowable over Sircar.

V. Rejections under 35 U.S.C. § 103 over Sircar in View of Dangieri and Mattia

Claims 162, 166 and 197 are rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Sircar in view of Dangieri, and further in view of Mattia, U.S. Patent No. 4,452,612 (Mattia). Applicants traverse this rejection and request that it be withdrawn.

Claims 162, 166 and 197 depend from independent claim 159. Applicants previously amended independent claim 159 to include the features of objected-to claim 182 concerning contaminant diffusion. This placed independent claim 159 in condition for allowance, and also addresses the rejection of claims 162, 166 and 197 over Sircar in view of Dangieri, and further in view of Mattia.

As discussed above, Sircar does not recognize forward diffusion of contaminant, provides no teaching or suggestion of a structure or process useful for addressing adsorbent contamination by diffusion, and hence does not anticipate or render obvious the features of independent claim 159. The references cited in combination with Sircar do not remedy the deficient teachings of Sircar with respect to the features of the rejected claims.

Applicants find no mention in Mattia or Dangieri of the desirability of removing adsorbent contaminants from the feed fluid. The present applicants have discovered that successful commercial implementation of methods for producing product fluids by pressure swing requires taking considerable steps to reduce adsorbent degradation or deactivation. Adsorbent degradation or deactivation can be so problematic as to require premature complete system shut down and replacement of the internally housed adsorbent. Applicants are aware of no teaching or suggestion in either Mattia or Dangieri concerning the need to substantially preclude adsorbent degradation or deactivation in a PSA system used to separate a product fluid from a feed fluid using the techniques claimed in the present application. Applicants therefore request that the rejection of claims 162, 166 and 197, which depend from independent claim 159, be withdrawn.

Dependent claims 162, 166 and 167 are further allowable over Sircar in view of Dangieri and Mattia vis-à-vis the patentable combination of features recited in these claims.

For example, claim 162 states that the apparatus is a rotary PSA apparatus operating at intermediate to high cycle frequencies of 10 cycles per minute or greater. Adsorbent contamination can be exacerbated in such rotary PSA devices due to the increased operating frequencies. By not recognizing the problems associated with diffusion contamination, the cited references also cannot recognize, and hence do not provide a solution to, the potential exacerbation of the problem in rotary PSA devices operating at moderate to high cycle frequencies. For at least this additional reason, dependent claim 162 is not obvious as the Office Action contends, and instead is in condition for allowance.

Claim 166 depends from claim 162 and is allowable for the reasons stated for claims 159 and claim 162.

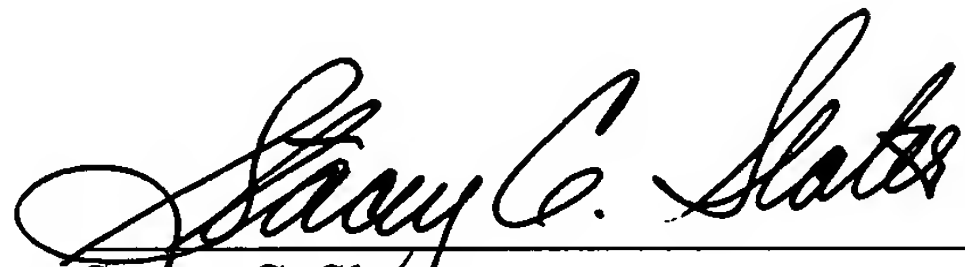
Claim 197 depends from claims 196, 161 and 159, and states that the apparatus is a rotary PSA apparatus operating at intermediate to high cycle frequencies of 10 cycles per minute or greater. Adsorbent contamination can be exacerbated in such rotary PSA devices due to the increased operating frequencies as discussed above for claim 162. Claim 196 also requires that the apparatus include a process containment seal that is not taught or suggested by the references cited against this application. Claim 197 thus is allowable for these additional reasons.

The present application is in condition for allowance and such action is requested. Examiner Lawrence is invited to call the undersigned if any questions remain before this application is allowed to issue.

Respectfully submitted,

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